

AMENDMENTS TO THE CLAIMS:

This listing of claims will replace all prior versions and listings of claims in the application:

1. (Currently Amended) An edge deviation calculation method in which a desired pattern is compared with a finish pattern to be formed on a wafer, ~~which is~~ the finish pattern being predicted from a design pattern, based on a calculation of a light beam intensity, and a deviation quantity of the finish pattern from the desired pattern at each ~~of edges~~ edge of the finish pattern and the desired pattern is calculated, the calculation method comprising:

setting a reference light beam intensity for setting the desired pattern on a wafer;
setting an evaluation point only on a target position of the desired pattern for comparison of the finish pattern with the desired pattern;
calculating a light beam intensity at the evaluation point;
calculating a differentiation value of the light beam intensity at the evaluation point;
calculating an intersection of the differentiation value with the reference light beam intensity; and
calculating a difference between the intersection and the evaluation point, wherein the difference is defined as an edge deviation quantity of the finish pattern from the desired pattern.

2. (Withdrawn) An edge deviation calculation method in which a desired pattern is compared with a finish pattern to be formed on a wafer, which is predicted from a design pattern, based on a calculation of a light beam intensity, and a deviation quantity

of the finish pattern from the desired pattern at each of edges of the finish pattern and the desired pattern is calculated, the calculation method comprising:

- setting a reference light beam intensity for setting the desired pattern on a wafer;
- setting an evaluation point for comparison of the finish pattern with the desired pattern;
- calculating a light beam intensity at the evaluation point;
- calculating a differentiation value of the light beam intensity at the evaluation point; and
- dividing a difference between the light beam intensity at the evaluation point and the reference light beam intensity by the differentiation value,

wherein a result of the division is defined as an edge deviation quantity of the finish pattern from the desired pattern.

3. (Currently Amended) The edge deviation calculation method according to claim 1, wherein the design pattern is a design pattern which specifies a complex transmission rate distribution, and the calculating of the light beam intensity at the evaluation point comprises:

- calculating ~~Fourier~~ a Fourier transform of the complex transmission rate distribution of the design pattern;
- calculating a mutual transmission coefficient;
- calculating a product of the mutual transmission coefficient with the complex transmission rate distribution and a value obtained as a result of the ~~Fourier~~ Fourier transform of the complex transmission rate distribution; and
- calculating a reverse Fourier transform of the product.

4. (Withdrawn) The edge deviation calculation method according to claim 2, wherein the design pattern is a design pattern which specifies a complex transmission rate distribution, and the calculating of the light beam intensity at the evaluation point comprises:

calculating Foulter transform of the complex transmission rate distribution of the design pattern;

calculating a mutual transmission coefficient;

calculating a product of the mutual transmission coefficient with the complex transmission rate distribution and a value obtained as a result of the Foulter transform of the complex transmission rate distribution; and

calculating reverse Foulter transform of the product.

5. (Original) The edge deviation calculation method according to claim 1, wherein the calculating of the light beam intensity at the evaluation point is obtained by a polynomial of n-story (n is a natural number) differentiation of the light beam intensity at the evaluation point.

6. (Withdrawn) The edge deviation calculation method according to claim 2, wherein the calculating of the light beam intensity at the evaluation point is obtained by a polynomial of n-story (n is a natural number) differentiation of the light beam intensity at the evaluation point.

7. (Currently Amended) The edge deviation calculation method according to claim 5, wherein, when an n-story differentiation of a light beam intensity in a [[the]] vicinity of a position coordinate $x = a$ of the evaluation point is defined as $f(x)^{(n)}$ ($n = 1, 2$

...), and a coefficient is defined as C_m ($m = 0, 1, 2, \dots$), a polynomial of the n-story differentiation is provided as the following polynomial:

$$f(x) = C_0 f(x=a) + C_1 f^{(1)}(x=a)(X-a) + \dots + C_{m-1} f^{(n-1)}(x=a)(X-a)^{n-1} + C_m f^{(n)}(x=a)(X-a)^n.$$

8. (Withdrawn) The edge deviation calculation method according to claim 6, wherein, when an n-story differentiation of a light beam intensity in the vicinity of a position coordinate $x = a$ of the evaluation point is defined as $f(x)^{(n)}$ ($n = 1, 2, \dots$), and a coefficient is defined as C_m ($m = 0, 1, 2, \dots$), a polynomial of the n-story differentiation is provided as the following polynomial:

$$f(x) = C_0 f(x=a) + C_1 f^{(1)}(x=a)(X-a) + \dots + C_{m-1} f^{(n-1)}(x=a)(X-a)^{n-1} + C_m f^{(n)}(x=a)(X-a)^n.$$

9. (Currently Amended) The edge deviation calculation method according to claim 5, wherein a polynomial of the n-story differentiation is provided as the following polynomial in which n-story differentiation of a light beam intensity in a [[the]] vicinity of a position coordinate $x = a$ of the evaluation point is obtained by Taylor expansion when $x = a$:

$$f(x) = f(x=a) + f^{(1)}(x=a)(X-a)/1! + f^{(2)}(x=a)(X-a)^2/2! + \dots + f^{(n)}(x=a)(X-a)^n/n!.$$

10. (Withdrawn) The edge deviation calculation method according to claim 6, wherein a polynomial of the n-story differentiation is provided as the following polynomial in which n-story differentiation of a light beam intensity in the vicinity of a position coordinate $x = a$ of the evaluation point is obtained by Taylor expansion when $x = a$:

$$f(x) = f(x = a) + f^{(1)}(x = a)(X - a)/1! + f^{(2)}(x = a)/2!(X - a)^2 + \dots + f^{(n)}(x = a)/n!(X - a)^n.$$

11. (Original) A edge deviation calculation method according claim 1, further comprising changing at least one of the reference light beam intensity and focus within each of determined ranges, and comparing the mask pattern with the finish pattern.

12. (Canceled)

13. (Original) A edge deviation calculation method according to claim 1, wherein the design pattern is a corrected pattern corrected to provide the desired pattern.

14. (Canceled)

15. (Currently Amended) An edge deviation quantity verification method in which a desired pattern is compared with a finish pattern to be formed on a wafer, the finish pattern being ~~which is~~ predicted from a design pattern, based on a calculation of a light beam intensity, a deviation quantity of the finish pattern from the desired pattern at each ~~of edges~~ edge of the finish pattern and the desired pattern is calculated, and it is determined whether or not the design pattern is to be corrected based on a result of the calculation of the deviation quantity, the verification method comprising:

setting a reference light beam intensity for setting the desired pattern on a wafer;

setting an evaluation point only on a target position of the desired pattern for comparison of the finish pattern with the desired pattern;

calculating a light beam intensity at the evaluation point;

calculating a differentiation value of the light beam intensity at the evaluation point;

calculating an intersection of the differentiation value with the reference light beam intensity;

calculating a difference between the intersection and the evaluation point, and define the calculated difference as an edge deviation quantity of the finish pattern from the desired pattern; and

verifying the edge deviation quantity,

wherein, in the case where the edge deviation quantity exceeds an allowable range, the design pattern is corrected based on the deviation quantity.

16. (Withdrawn) An edge deviation quantity verification method in which a desired pattern is compared with a finish pattern to be formed on a wafer, which is predicted from a design pattern, based on a calculation of a light beam intensity, a deviation quantity of the finish pattern from the desired pattern at each of edges of the finish pattern and the desired pattern is calculated, and it is determined whether or not the design pattern is to be corrected based on a result of the calculation of the deviation quantity, the verification method comprising:

setting a reference light beam intensity for setting the desired pattern on a wafer;

setting an evaluation point for comparison of the finish pattern with the desired pattern;

calculating a light beam intensity at the evaluation point;

calculating a differentiation value of the light beam intensity at the evaluation point;

dividing a difference between the light beam intensity at the evaluation point and the reference light beam intensity by the differentiation value, and defining a result of the division as an edge deviation quantity; and

verifying the edge deviation quantity,

wherein, in the case where the edge deviation quantity exceeds an allowable range, the design pattern is corrected based on the deviation quantity.

17. (Withdrawn) An edge deviation quantity verification program in which a desired pattern is compared with a finish pattern to be formed on a wafer, which is predicted from a design pattern, based on a calculation of a light beam intensity, a deviation quantity of the finish pattern from the desired pattern at each of edges of the finish pattern and the desired pattern is calculated, and it is verified whether or not the design pattern is to be corrected based on a result of the calculation of the deviation quantity, the verification program comprising:

setting a reference light beam intensity for setting the desired pattern on a wafer;

setting an evaluation point for comparison of the finish pattern with the desired pattern;

calculating a light beam intensity at the evaluation point;

calculating a differentiation value of the light beam intensity at the evaluation point;

calculating an intersection of the differentiation value with the reference light beam intensity;

calculating a difference between the intersection and the evaluation point, and define the calculated difference as an edge deviation quantity of the finish pattern from the desired pattern; and

verifying the edge deviation quantity,

wherein, in the case where the edge deviation quantity exceeds an allowable range as a result of the verification, the design pattern is corrected based on the deviation quantity.

18. (Withdrawn) An edge deviation quantity verification program in which a desired pattern is compared with a finish pattern to be formed on a wafer, which is predicted from a design pattern, based on a calculation of a light beam intensity, a deviation quantity of the finish pattern from the desired pattern at each of edges of the finish pattern and the desired pattern is calculated, and it is verified whether or not the design pattern is to be corrected based on a result of the calculation of the deviation quantity, the verification program comprising:

setting a reference light beam intensity for setting the desired pattern on a wafer;

setting an evaluation point for comparison of the finish pattern with the desired pattern;

calculating a light beam intensity at the evaluation point;

calculating a differentiation value of the light beam intensity at the evaluation point;

dividing a difference between the light beam intensity at the evaluation point and the reference light beam intensity by the differentiation value, and defining a result of the division as an edge deviation quantity; and

verifying the edge deviation quantity,

wherein, in the case where the edge deviation quantity exceeds an allowable range, the design pattern is corrected based on the deviation quantity.

19. (Withdrawn) An edge position quantity verification system having an input/output circuit, a storage, a computer, a display and a controller, in which a desired pattern is compared with a finish pattern to be formed on a wafer, which is predicted from a design pattern, based on a calculation of a light beam intensity, a deviation quantity of the finish pattern from the desired pattern at each of edges of the finish pattern and the desired pattern is calculated, and it is verified whether or not the design pattern is to be corrected based on a result of the calculation of the deviation quantity, the verification system comprising:

setting a reference light beam intensity for setting the desired pattern on a wafer;

setting an evaluation point for comparison of the finish pattern with the desired pattern;

calculating a light beam intensity at the evaluation point;

calculating a differentiation value of the light beam intensity at the evaluation point;

calculating an intersection of the differentiation value with the reference light beam intensity;

calculating a difference between the intersection and the evaluation point, and define the calculated difference as an edge deviation quantity of the finish pattern from the desired pattern; and

verifying the edge deviation quantity,

wherein, in the case where the edge deviation quantity exceeds an allowable range as a result of the verification, the design pattern is corrected based on the deviation quantity.

20. (Withdrawn) An edge position quantity verification system having an input/output circuit, a storage, a computer, a display and a controller, in which a desired pattern is compared with a finish pattern to be formed on a wafer, which is predicted from a design pattern, based on a calculation of a light beam intensity, a deviation quantity of the finish pattern from the desired pattern at each of edges of the finish pattern and desired pattern is calculated, and it is verified whether or not the design pattern is to be corrected based on a result of the calculation of the deviation quantity, the verification system comprising:

setting a reference light beam intensity for setting the desired pattern on a wafer;

setting an evaluation point for comparison of the finish pattern with the desired pattern;

calculating a light beam intensity at the evaluation point;

calculating a differentiation value of the light beam intensity at the evaluation point;

dividing a difference between the light beam intensity at the evaluation point and the reference light beam intensity by the differentiation value, and defining a result of the division as an edge deviation quantity; and

verifying the edge deviation quantity,

wherein, in the case where the edge deviation quantity exceeds an allowable range, the design pattern is corrected based on the deviation quantity.

21. (Withdrawn) A semiconductor device manufacturing method in which a desired pattern is compared with a finish pattern to be formed on a semiconductor wafer, which is predicted from a design pattern, based on a calculation of a light beam intensity, a deviation quantity of the finish pattern from the desired pattern at each of edges of the finish pattern and desired the pattern is calculated, it is verified whether or not the design pattern is to be corrected based on a result of the calculation of the deviation quantity, and a semiconductor device is manufactured by using a mask having the design pattern corrected based on the verification, the manufacturing method comprising:

- setting a reference light beam intensity for setting the desired pattern on a wafer;
- setting an evaluation point for comparison of the finish pattern with the desired pattern;
- calculating a light beam intensity at the evaluation point;
- calculating a differentiation value of the light beam intensity at the evaluation point;
- calculating an intersection of the differentiation value with the reference light beam intensity;
- calculating a difference between the intersection and the evaluation point, and define the calculated difference as an edge deviation quantity of the finish pattern from the desired pattern;
- verifying the edge deviation quantity;
- correct the design pattern based on the deviation quantity, in the case where the edge deviation quantity exceeds an allowable range;

forming a mask having the design pattern corrected based on the deviation quantity; and

forming a pattern corresponding to the corrected design pattern on a semiconductor wafer by using the mask to form a semiconductor device on the semiconductor wafer.

22. (Withdrawn) A semiconductor device manufacturing method in which a desired pattern is compared with a finish pattern to be formed on a semiconductor wafer, which is predicted from a design pattern, based on a calculation of a light beam intensity, a deviation quantity of the finish pattern from the desired pattern at each of edges of the finish pattern and the desired pattern is calculated, it is verified whether or not the design pattern is to be corrected based on a result of the calculation of the deviation quantity, and a semiconductor device is manufactured by using a mask having the design pattern corrected based on the verification, the manufacturing method comprising:

setting a reference light beam intensity for setting the desired pattern on a wafer;
setting an evaluation point for comparison of the finish pattern with the desired pattern;

calculating a light beam intensity at the evaluation point;
calculating a differentiation value of the light beam intensity at the evaluation point;

dividing a difference between the light beam intensity at the evaluation point and the reference light beam intensity by the differentiation value, and defining a result of the division as an edge deviation quantity; and

verifying the edge deviation quantity,
correct the design pattern based on the deviation quantity, in the case where the edge deviation quantity exceeds an allowable range;
forming a mask having the design pattern corrected based on the deviation quantity; and
forming a pattern corresponding to the corrected design pattern on a semiconductor wafer by using the mask to form a semiconductor device on the semiconductor wafer.

23. (New) The edge deviation calculation method according to claim 1, wherein the target position of the desired pattern includes each of the edges of the desired pattern.

24. (New) The edge deviation calculation method according to claim 15, wherein the target position of the desired pattern includes each of the edges of the desired pattern.